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Abstract

Purpose: Physician clinical investigators are crucial translators of scientific advancements into better health. Since the 1970s, leading academics have warned of a looming national shortage of these investigators, but evidence has been largely indirect or anecdotal. We sought to examine whether the supply of new clinical investigators is sufficient to meet the demand for physician assistant professors in patient-oriented research (POR) in U.S. allopathic medical schools.

Methods: A survey of the years 2002 to 2004 was conducted of chairs of selected clinical departments at U.S. medical schools to determine the number of junior physician clinical investigators in POR in these departments, the prevalence of open positions for such individuals, and success or failure in filling these positions.

Results: Most (68%) responding clinical departments reported having openings for junior physician investigators in POR, totaling 2,097 positions. Slightly more than half (52%) of the departments with openings were not able to fill all their positions, and 27 percent of all openings went unfilled.

Conclusions: The data provide a quantitative estimate of the shortage of physician investigators in POR during 2002–2004, underscore the troubling role of attrition and high turnover rates in stunting the growth of the nation's clinical and translational research workforce, and provide a rationale for bold policy interventions like those recently implemented by the National Institutes of Health (NIH) and called for by the academic medical community.

Introduction

In recent decades, many leaders in biomedical research—in medical schools, teaching hospitals, federal agencies, and the biopharmaceutical industry—have warned about a potential shortfall in the number of appropriately trained physician clinical investigators.^{1–7} These investigators are indispensable for a robust national clinical research enterprise. It has been noted that over the past several decades, the share of NIH-funded researchers who are physician-scientists has declined relative to the share of Ph.D. researchers.^{2,3} Although the number of physician principal investigators (PIs) on NIH research projects has increased over this period, the increase has been notably small, and this might indicate a limited pool of physician investigators.^{8–10}

The only prior study of which we are aware that tried to quantify the supply and demand for junior physician investigators in academic clinical research is that of Campbell and colleagues.¹¹ In their survey of senior research administrators and department chairs at U.S. medical schools in 1999, 75 percent of all respondents identified recruiting trained investigators in the clinical disciplines to be a moderate or large problem.¹¹ However, 53 percent responded identically for recruitments in the basic sciences, and the authors acknowledged that their survey could not ascertain the extent to which respondents' perceptions adequately reflected the complexities of recruiting young scientists generally in competitive academic environments. To reexamine and update these findings, we gathered information about the supply of and demand for physician assistant professors in POR, including the number of these investigators in clinical departments, the prevalence of open positions for such individuals, and success or failure in filling these positions.

Methods

For the purposes of this study, *clinical research* is defined as patient-oriented research utilizing data or samples that require direct interaction with human subjects.* *Junior physician* investigators in clinical research are defined as full-time assistant professors with M.D. or M.D.–Ph.D. degrees expected to devote at least 30 percent of their time to patient-oriented research. The sample for this survey consisted of chairs of clinical departments in eight disciplines at all 125 accredited allopathic medical schools in the United States. These departments contain most faculty positions involved with POR: internal medicine, neurology, obstetrics and gynecology (ob/gyn), pathology, pediatrics, psychiatry, radiology, and surgery.

The survey (Appendix) was sent to the 837 chairs of these departments in January 2005, based on a list obtained from the Association of American Medical Colleges' (AAMC) Faculty Roster. Of these, 113 were from departments of medicine, 110 from pediatrics, 109 from pathology, 109 from ob/gyn, 100 from radiology, 106 from surgery, 98 from psychiatry, and 92 from neurology. (Note that not all medical schools have these eight separate departments and that the sample excludes chairs that had recently left their positions). Draft survey instruments were pre-tested at several clinical departments representing the different disciplines. We received strongly delivered messages that chairs and their administrators were much too busy to search departmental records to provide the detailed information requested, and that only a simplified survey would work. The final questionnaire was sent to department chairs starting in January 2005, with repeat mailings (up to five) until September 2005. Responses were received via the Internet (e-mail and Web-based form), fax, and mail.

The survey asked responding chairs to provide contact information, and to fill in numbers for the questions: How many full-time assistant professors with M.D. or M.D.–Ph.D. degrees were in your department at the end of 2004 (please also include those principally working at teaching hospitals or campuses remote from the main campus) and were expected to devote at least 30 percent of their time to patient-oriented research?; in the past 3 years (2002–2004), how many full-time assistant professorships has your department attempted to fill with M.D.'s or M.D.–Ph.D.'s who were expected to devote at least 30 percent of their time to patient-oriented research?; and, of the positions identified above, how many have been filled? To examine the effect of differences in research intensity of the medical schools on response rates, we stratified respondents by their schools' rankings as recipients of NIH awards in 2004, which we considered a reasonable proxy. School rankings were preferred over departmental rankings, which are subject to distortion by variable names and compositions of departments in different schools. Indeed, the NIH has recently ceased providing departmental rankings because of increasing complaints about their reliability. Statistical analysis was performed using the chi-square test. As a conservative measure, the Bonferroni correction was used for these three-group comparisons; thus, chi-square calculated p values were multiplied by 3.

* The functional definition of clinical research is indeed much broader. As advanced by the Clinical Research Summit project: Clinical research embraces a continuum of studies involving interactions with patients, diagnostic clinical materials or data, or populations in any of the following categories: 1. disease mechanisms (etiopathogenesis); 2. bidirectional integrative (translational) research; 3. clinical knowledge, detection, diagnosis, and natural history of disease; 4. therapeutic interventions, including clinical trials of drugs, biologics, devices, and instruments; 5. prevention (primary and secondary) and health promotion; 6. behavioral research; 7. health services research, including outcomes, and cost effectiveness; 8. epidemiology; and 9. community-based trials.⁸

Results

Responses to the survey

Of the chairs surveyed, 498 (60%) completed the questionnaire—a higher-than-average response rate for physician surveys.¹² Stratifying response rates by research intensity, 183 (63%) of the surveyed departments at the 40 most research-intensive medical schools, 171 (60%) of departments in schools ranked 41–80, and 144 (55%) of departments ranked 81–125 responded to the survey, and these rates were not statistically different (Table 1). Since most junior clinical research faculty in academic medicine work at research-intensive schools (see Table 1), we were comfortable that our sample fairly represented the job market for physician clinical investigators in the medical school population. Across disciplines, the response rate varied from a high of 70 percent in ob/gyn to a low of 51 percent in medicine.

Number of physician assistant professors in patient-oriented research in clinical departments

The total number of physician assistant professors in patient-oriented research reported by responding departments at the end of 2004 was 2,877 (Table 1). Nationwide, 337 (68%) clinical departments employed physician assistant professors who spent at least 30 percent effort conducting POR. At schools ranked in the NIH top 40, 159 (87%) departments reported having such positions, with a total of 1,964 positions reported. The corresponding figures were 116 (68%) departments for schools ranked 41–80, with a total of 684 positions, and 62 (43%) departments at schools ranked 81–125, with a total of 229 positions. These differences were statistically significant. The mean number of such positions per department also varied by research rank with top 40 schools having a mean of 12.4 such positions (range 1–122), schools ranked 41–80 having a mean of 5.9 (range 1–48), and schools ranked 81–125 having a mean of 3.7 (range 1–25). These differences were also statistically significant. Of the total reported number of physician assistant professors in POR, about two-thirds (68%) worked in clinical departments at the top 40 schools, about one-fourth (24%) at the 41–80 schools, and only 8 percent at the 81–125 schools. Analysis of the data by department indicated, not surprisingly, that the majority (53%) of such positions were located in departments of internal medicine (33%) and pediatrics (22%).[†]

Demand for physician assistant professors in patient-oriented research

The total number of open positions reported by responding departments for the three years 2002 to 2004 was 2,097 (Table 2). One hundred and fifty-four departments at the top 40 institutions (84% of respondents) had a total of 1,310 such openings, compared to 118 departments at schools ranked 41–80 (69% of respondents, 565 total openings) and 66 departments at schools ranked 81–125 (46% of respondents, 222 total openings). The differences in the percentages of departments with openings were statistically significant. The number of openings reflected both the research intensity of the school as well as the distribution of total positions among departments, with internal medicine having 31 percent and pediatrics 22 percent.

[†] In 2004–05 allopathic medical schools reported employing 98,256 full-time faculty in the clinical disciplines. Of these, 28,439 were in internal medicine and 13,688 in pediatrics.¹⁸

Unmet demand for M.D. assistant professors in POR

Of the clinical departments that had openings for physician assistant professors in POR between 2002 and 2004, 176 or slightly more than half (52%) could not fill all openings (Table 2). Surprisingly, even among research-intensive (top 40) schools, 69 (45%) of the departments could not fill all openings, with nearly one-fifth (253, 19%) of the openings unfilled. At less research-intensive schools (41–80 and 81–125), a somewhat higher percentage of departments could not fill all openings (67 departments, 57%; and 40 departments, 61%, respectively), and approximately two-fifths of the openings went unfilled (38% and 41%, respectively). However, differences in the percentage of departments that could not fill all openings were not statistically significant. Among specialties, surgery reported the least trouble filling such positions (15% unfilled), while radiology and psychiatry had the most trouble (38% and 37%, respectively).

Conclusion and Discussion

Between 2002 and 2004, most (68%) of the responding clinical departments reported having openings for junior physician investigators in POR, totaling 2,097 over the three-year period. Because the survey sample was reasonably representative of the medical school population, these data suggest that during that three-year interval, approximately 3,500 such openings in U.S. allopathic medical schools may have existed. Notably, more than half (52%) of the departments with openings were not able to fill all positions, and 27 percent of all openings went unfilled. The total number of unfilled positions reported (558) supports an estimate of 930 unfilled positions in the medical school population at the end of 2004, representing a significant fraction ($930/3,500$, 27%) of the total POR positions available for junior physician investigators during the three-year interval. Moreover, given that by the end of 2004 the responding departments reported a total of 2,877 positions filled by junior physician investigators in POR, the unfilled positions represented a significant fraction (16%) of the respondents' total junior physician POR workforce ($558/(2,877 + 558)$) in that year.

Although we were unable to obtain information explaining why the responding departments were unable to fill all their openings, the data are consistent with the interpretation that insufficient numbers of junior physician clinical researchers were available to meet the needs of the academic medical research agenda. Although the reported difficulty in recruitment was more severe in the less research-intensive schools, even the most research-intensive schools were unable to fill nearly one-fifth of their open positions.

From a national perspective, these findings provide quantitative support for the frequently reiterated anecdotal warnings about the need for more translational and clinical researchers nationwide.^{12–16} Moreover, since our findings are confined to the academic sector, they do not address the comparable difficulties faced by industry¹⁷ and other sectors in recruiting new physician investigators; thus, they likely underestimate the magnitude of the problem. Not surprisingly, recruitment challenges appear to be most acute for academic medical institutions that rank lowest in terms of NIH funding, but these include smaller institutions with excellent clinical research programs, as well as centers serving historically underserved populations or have an extensive presence in communities not otherwise connected to academic research.

This study has several limitations. First, the veracity of the data assumes accurate record keeping and reporting by the responding chairs because we cannot independently verify the accuracy of the responses. We believe the assumption is reasonable because we simplified the survey to engender respectable response rates (see Methods). Second, we cannot distinguish to what extent the observed shortfall may have been due to an absolute insufficiency of qualified candidates; an inadequacy of departmental or institutional resources; or because qualified candidates made other career choices, such as going to industry or into clinical practice. Factors that drive such alternative choices are noted below. As we note under “Methods,” our original, more comprehensive survey instrument was designed to help illuminate these alternatives, but proved infeasible. Third, we have no information as to whether the individuals hired into these positions were adequately trained in clinical research, or whether they were sufficiently supported once appointed, to succeed in a research career. Inadequate training or support could certainly have contributed to high attrition and turnover.

Inferences can be drawn from the data that there was indeed high turnover. Notably, departments reported 73 percent as many open positions for M.D. assistant professors in POR during the three-year period from 2002 to 2004 (2,097, Table 2) as the total complement of junior physician faculty employed at the end of 2004 (2,877, Table 1). The number of such positions filled during the three-year interval (open positions minus unfilled positions = 1,539) represents 53 percent of the total filled positions at the end of 2004. Some might argue that the large number of reported open positions reflected optimistic plans for expansion of these departments because of the doubling of the NIH budget completed in FY 2003. Although possible, we believe it is unlikely that institutions were nearly doubling their efforts in POR during the sampled interval. For example, the total number of full-time faculty in clinical departments at all U.S. medical schools grew by 8.9 percent (90,181 to 98,256) from academic years 2002–03 to 2004–05.^{18,19} Rather, we believe the survey data may reflect the attrition and high turnover rates that play a troubling role in stunting the growth of the nation’s clinical and translational research workforce. The AAMC’s Task Force II on Clinical Research^{20,21} examined the training and support of new physician clinical investigators, and noted that their attrition is “disturbingly high.”

Among the contributory factors identified, the task force pinpointed the deficiency of institutional and environmental sources of support for junior clinical investigators and noted insufficient training and mentorship, lack of scrupulously protected time for research and for mentoring, the off-putting complexity of regulatory requirements in research involving human participants, and disproportionate financial incentives for full-time clinical practice. Moreover, attrition is notable even among those who have succeeded in competing for sponsored research and career development support. For example, among individuals who received Clinical Associate Physician (CAP) research career development awards (a mechanism subsequently replaced by the NIH’s K-23 mentored POR investigator award), slightly more than 60 percent went on to apply for other NIH research awards, but fewer than half applied for NIH R01 awards, and only half of those were successful.²⁰

Given the critical role played by physician clinical investigators in translating basic research discoveries into public benefit, both the real and the opportunity costs to the nation of clinical investigator attrition are matters of concern.

The AAMC task force proposed a number of reforms to address these problems, including increased institutional support and oversight of clinical research and research training, enhanced clinical research training at all levels of undergraduate and graduate medical education to help physician investigators achieve independence earlier in their careers, and the fostering of rigorous standards in clinical research training to equip new physician investigators to be more attractive to medical schools and more competitive for sponsored research funding. These recommendations dovetail with the recently launched NIH Clinical and Translational Science Awards intended to stimulate academic medical centers to create true “academic homes” for clinical research. Together, they may begin to redress a persistent workforce problem that has prevented this nation from developing a robust clinical research enterprise commensurate with scientific opportunity and public health need.

Acknowledgment: The authors thank Charles Moldow, M.D., of the University of Minnesota School of Medicine and other members of the AAMC’s Task Force II on Clinical Research for early advice and guidance on the survey; Hershel Alexander, Ph.D., of the AAMC for assistance in identifying clinical departments at U.S. medical schools; and most especially, the chairs and staff of those departments and their deans who participated in the study.

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Table 1

Number of Departments Responding and Number of Physician Assistant Professors in Patient-oriented Research at the End of 2004, by School Research Rank

	Top 40 School # (%)	41-80 School # (%)	81-125 School # (%)	Total # (%)
Departments responding (% of identified departments in cohort)	183 (63)	171 (60)	144 (55)	498 (60)
Departments with M.D. assistant professors in POR (% of responding departments)	159 (87)	116 (68)	62 (43)	337 (68)
Mean number of M.D. assistant professors in POR per department (range)	12.4 (range 1–122)	5.9 (range 1–48)	3.7 (range 1–25)	8.5 (range 1–122)
Total number of M.D. assistant professors in POR in responding departments by school research rank (% of total)	1,964 (68)	684 (24)	229 (8)	2,877 (100)

Chi-square analysis with Bonferroni correction:

Percentage of departments responding – 1–40 vs. 41–80 $p > .999$; 1–40 vs. 81–125 $p = 0.122$; 41–80 vs. 81–125 $p = 0.494$.

Percentage of responding departments with assistant professors in POR – 1–40 vs. 41–80 $p < .001$; 1–40 vs. 81–125 $p < .001$; 41–80 vs. 81–125 $p < .001$.

Mean number of M.D. assistant professors in POR per department – 1–40 vs. 41–80 $p < .001$; 1–40 vs. 81–125 $p < .001$; 41–80 vs. 81–125 $p = .032$.

Table 2

Departments with Open Positions for M.D. Assistant Professors in POR and Positions that Remained Unfilled, by School Research Rank, 2002–2004

	Top 40 School # (%)	41-80 School # (%)	81-125 School # (%)	Total # (%)
Number of departments with openings (% of responding departments with openings)	154 (84%)	118 (69%)	66 (46%)	338 (68%)
Total number of openings (% of total openings by school category)	1,310 (62%)	565 (27%)	222 (11%)	2,097 (100%)
Number and (%) of departments that did not fill all open positions	69 (45%)	67 (57%)	40 (61%)	176 (52%)
Total number of unfilled openings (% of open positions that were not filled)	253 (19%)	215 (38%)	90 (41%)	558 (27%)

Chi-square analysis with Bonferroni correction:

Percentage of responding departments with openings – 1–40 vs. 41–80 $p = .002$; 1–40 vs. 81–125 $p < .001$; 41–80 vs. 81–125 $p < .001$.

Percentage of departments that did not fill all openings – 1–40 vs. 41–80 $p = .151$; 1–40 vs. 81–125 $p = .095$; 41–80 vs. 81–125 $p > .999$.

Appendix

AAMC Survey on Recruitment and Retention of MD Assistant Professors in Clinical Research 2005

Your contact information:

Name: _____ Title: _____

Phone: _____ Email: _____

Department: _____

Medical School: _____

Recruitment of MD Assistant Professors in Clinical Research

1. How many **full-time** assistant professors with MD or MD-PhD degrees were in your department at the **end of 2004**? (Please also include those who were principally working at teaching hospitals or campuses remote from the main campus) _____
2. Of the assistant professors identified above, how many were expected to devote at least **30% of time to patient-oriented research**¹? _____
3. **In the past 3 years** (2002-2004), how many full-time assistant professorships has your department attempted to fill with MDs or MD-PhDs who were expected to devote at least **30% of time to patient-oriented research**? _____
4. Of the positions identified above, how many have been filled? _____
5. Of the faculty recruited, as identified in Question 4, how many have been supported by external research funding from the following sources after their recruitment:
 - NIH _____
 - VA _____
 - Foundation _____
 - Industry _____
 - Other _____ (specify: _____)
 - Unknown _____

¹For purposes of this study, we define **patient-oriented research** as research utilizing data or samples that require direct interaction with human subjects.

AAMC Survey Clearance Number: 04-047

6. Regarding the full-time assistant professorships that your department has been unable to fill **in the past 3 years** (2002-2004) with MDs or MD-PhDs who were expected to devote at least 30% **of time to patient-oriented** research, please rate the importance of each of the following reasons:

	Not a problem	Small problem		Moderate problem	Serious problem	Very Serious problem	Don't Know
	0	1	2	3	4	5	
1). Inability to identify qualified candidates	_____	_____	_____	_____	_____	_____	_____
2). Qualified candidates identified, but declined to accept offered position	_____	_____	_____	_____	_____	_____	_____
3). Other(s) (Specify: _____)	_____	_____	_____	_____	_____	_____	_____

7. If “Qualified candidates were identified but declined to accept offered positions” is identified as a moderate, serious, or very serious problem in Question 6, please rate the importance of each of the following reasons:

	Not a problem	Small problem		Moderate problem		Very Serious problem	Don't Know
	0	1	2	3	4	5	
1). Could not provide the asked research time	_____	_____	_____	_____	_____	_____	_____
2). Could not provide the asked research resources	_____	_____	_____	_____	_____	_____	_____
3). Could not provide the asked financial compensation	_____	_____	_____	_____	_____	_____	_____
4). Family/spouse reasons	_____	_____	_____	_____	_____	_____	_____
5). Location reasons	_____	_____	_____	_____	_____	_____	_____
3). Other(s) (Specify: _____)	_____	_____	_____	_____	_____	_____	_____

Retention of MD Assistant Professors in Clinical Research

8. **In the last 5 years**, how difficult was it to retain full-time assistant professors with MD or MD-PhD degrees in your department who devoted at least **30% of time to patient-oriented research**?

Not a problem	Small problem		Moderate problem		Very Serious problem	Don't Know
0	1	2	3	4	5	
_____	_____	_____	_____	_____	_____	_____

9. For the MD or MD-PhD assistant professors who devoted at least **30% of time to patient-oriented research** and who left the tenure track or the department **in the last 5 years**, please rate the importance of each of the following reasons:

	Not a problem	Small problem		Moderate problem		Very Serious problem	Don't Know
	0	1	2	3	4	5	
1). Failure to obtain external research support	_____	_____	_____	_____	_____	_____	_____
2). Insufficient time to develop and conduct research projects	_____	_____	_____	_____	_____	_____	_____
3). Change in career plan due to loss of interest	_____	_____	_____	_____	_____	_____	_____
4). Change in career plan due to financial reasons	_____	_____	_____	_____	_____	_____	_____
5). Change in career plan due to family/spouse reasons	_____	_____	_____	_____	_____	_____	_____
6). Other(s) (Specify: _____)	_____	_____	_____	_____	_____	_____	_____

10. To what extent is the cost of malpractice insurance limiting opportunities in clinical research for MD assistant professors in your department?

Not a problem	Small problem		Moderate problem		Very Serious problem	Don't Know
0	1	2	3	4	5	
_____	_____	_____	_____	_____	_____	

Your Department's MD Trainees for Clinical Research

11. **In the past 3 years** (2002-2004), how many MD or MD-PhD assistant professors or instructors have completed **postdoctoral fellowship** training in **patient-oriented research** within your department?

- In degree program _____
- In non-degree program _____

12. **In the past 3 years** (2002-2004), how many non-faculty fellows with MD or MD-PhD degrees have completed **postdoctoral fellowship** training in **patient-oriented research** within your department (Please do not include residents)?

- In degree program _____
- In non-degree program _____

13. Of the trainees identified in Question 12, to the best of knowledge, how many had the following positions as their first employment?

- Faculty in tenure track at an academic institution _____
- Faculty in non-tenure track at an academic institution _____
- Clinical practice _____
- Industry _____
- Government or non-profit organization _____
- Still searching for a job _____
- Additional training _____
- Other(s) _____ (specify: _____)
- Unknown _____

14. If you have any additional comments, please use the section below: